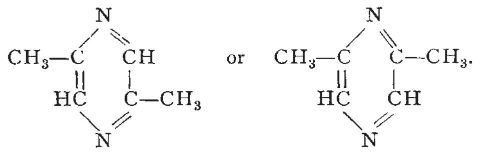
Dr. Stoehr has also discovered their presence in the products of distillation of the alkaloid brucine. The best investigated member of the series, $C_6H_8N_2$, is a clear colourless liquid just slightly heavier than water, its sp. gr. at 0° being 1·0079. It boils constantly without decomposition at 153°·5–154° C. (corr.), and determinations of its vapour density at the temperature of naphthalene vapour by Victor Meyer's method yield numbers pointing to the above molecular composition. From its reactions it appears to be the dimethyl derivative of the primary diamine, and may consequently possess the constitution



It exhibits almost all the properties of the pyridine bases. Its odour is very similar to that of the higher members of that series, but reminds one, at the same time, of the narcotic bases, particularly nicotine. It is soluble in water, dissolving with such considerable rise of temperature as to indicate the formation of a hydrate; it is precipitated from its aqueous solution on the addition of potash. It is, curiously, nearly as soluble in cold water as in hot—a phenomenon which is familiar to us in the case of common salt. Its salts are most remarkably like those of the pyridines, and the peculiarities exhibited by the latter are strongly accentuated in them. Thus the hydrochloride, $C_6H_8N_2.HCl$, is deliquescent and sublimes below 100°. The platinochloride, $C_6H_8N_2.2HCl.PtCl_4 + 3H_2O$, which forms fine crystals of the colour of bichromate of potash, possesses in a marked manner the property so characteristic of the platinochlorides of the pyridines, known as "Anderson's reaction," of parting with hydrochloric acid on warming in solution, and depositing condensed salts. On merely warming the solution, bright yellow crystals of the salt $(C_6H_8N_2)_2PtCl_4$ commence to deposit. The double salt with gold chloride, $C_6H_8N_2.HCl.AuCl_3$, forms magnificent acicular crystals several inches long, while the mercuric chloride salt forms large rhombohedrons. The second member of the series investigated proved to have the molecular composition $C_8H_{12}N_2$, and to be an ethyl derivative of the primary diamine. It was likewise a liquid, boiled at 178°·5 (corr.), and possessed properties analogous to the methyl compound just described.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Count Povoleri, F.Z.S.; a Ring-tailed Coati (*Nasua rufa* ♂) from Guatemala, presented by Mr. Cyril Smith; two Hawfinches (*Coccothraustes vulgaris*), British, presented by Mr. J. Newton Hayley; two Blood-breasted Pigeons (*Phlœgnas cruentata*) from the Philippine Islands, a Chinese Turtle Dove (*Turtur chinensis*) from India, presented by Mr. Wilfred G. Marshall; a Rhesus Monkey (*Macacus rhesus* ♀) from India, a Yellow-crowned Penguin (*Eudyptes antipodum*) from New Zealand, deposited.

OUR ASTRONOMICAL COLUMN.

DARK TRANSITS OF JUPITER'S SATELLITES.—The Publications of the Astronomical Society of the Pacific, vol. ii. No. 11, contains several communications on dark transits of the satellites of Jupiter. Mr. Keeler sums up the phenomena as follows:—

(1) In ordinary transits, the satellite is bright when projected upon the surface of Jupiter near the limb, and is usually lost sight of when it reaches the central parts of the disk.

(2) Occasionally the satellite appears darker than the surface of Jupiter when in transit, even when projected on the brightest parts of the disk, and the depth of shade may be very considerable, as a satellite has often been mistaken for its shadow. On leaving the disk, the satellite nevertheless appears quite bright when projected against the sky.

(3) Dark transits of satellites increase in frequency with the order of distance from the primary, being more common for the outer satellites than for the inner ones.

(4) The phenomena are irregular in occurrence, and therefore not predictable.

In order to account for these facts a variety of theories have been propounded. Mr. Keeler advances the idea that the satellites are surrounded by atmospheres containing large quantities of aqueous vapour. A circulation of clouds may thus be set up by means of the intrinsic heat of the central planet. The cloud surfaces of the primary and its satellites being similar, the albedo of the two may be equal. If, however, any accidental disturbance should be set up which would cause a precipitation on the side of the satellite furthest from the source of heat, the albedo would be diminished, and if, at such a time, the satellite was passing across the disk of Jupiter, we should have the phenomena of a dark transit. On this supposition the unstable condition of the atmospheres of the outer satellites sufficiently explains their frequent dark transits.

A simpler and therefore more probable explanation is supported by Prof. Holden. It is that the phenomena of both bright and dark transits depend upon the contrast between the brightness of a satellite and that of the part of the planet upon which it happens to be projected. He finds that much of Jupiter's surface is only about three or four times as bright as the limbs—that is, has an albedo three or four times 0·07. If this be so, then on a background of 0·21 or 0·28, the first satellite, having an albedo of 0·22, or the second, with an albedo of 0·27, would usually be lost. Careful observations of the phenomena attending these transits will considerably elucidate the matter.

SOLAR ACTIVITY (JULY–DECEMBER 1890).—In *Comptes rendus* for January 19, Prof. Tacchini gives the following *résumé* of the solar observations made at the Royal Observatory of the Roman College during the second half of 1890:—

1890.	Relative frequency of spots.	Relative frequency of days without spots.	Relative magnitude of spots.	Relative magnitude of faculæ.	Number of groups per day.
July	3·80	0·40	8″·23	12″·83	0·97
August	3·42	0·52	15·29	11·77	0·68
September	5·83	0·18	23·68	22·32	1·46
October	3·17	0·58	17·33	10·83	0·75
November	2·45	0·50	7·95	22·75	0·55
December	3·38	0·38	9·25	17·75	0·81

The observations extend over 149 days. The following are the results obtained for solar prominences:—

1890.	Number of days of observation.	Prominences: Mean number.	Prominences: Mean height.	Prominences: Mean extension.
July	30	2·07	33″·8	1°·4
August	31	2·65	27·5	1·1
September	24	2·88	35·8	1·2
October	22	8·05	40·6	1·5
November	16	2·13	28·0	1·5
December	12	3·42	40·4	1·6

M. Marchand, in the same number, gives the result of sunspot observations made at Lyons Observatory last year. The following are the mean total areas of the groups measured expressed in millionths of the sun's visible hemisphere:—

January	22·5	July	49·7
February	20·0	August	51·0
March	51·0	September	154·1
April	34·6	October	160·5
May	20·5	November	137·2
June	8·3	December	41·0

M. Marchand remarks that in 1890 the proportion of days without spots was 0·456, whilst it was 0·555 in 1889. On the other hand, in 1889, only 29 groups of spots were observed, having a total surface area of 1890 millionths of the sun's visible hemisphere. In 1890, 43 groups had a total surface area of 3760 millionths. It is evident, therefore, that there was a sensible augmentation of solar activity last year.

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PLANET OR NEW STAR ?—The current number of *Comptes rendus* contains an announcement which astronomers would regard with much interest if it were substantiated. Dr. Lescarbault, the astronomer on whose statement the existence of the intra-Mercurial planet Vulcan mainly relies, observed a bright body in Leo on January 11, and, being unable to find it mapped in any atlas in his possession, he estimated its position as R.A. 11h. 4m., Decl. 6°, and concluded that the body was a new star, or one suddenly increased in brilliancy. There is little doubt, however, but that Dr. Lescarbault is mistaken in his conclusions, and that the body observed was the planet Saturn, whose position on the date named was R.A. 11h. 15m., Decl. 6° 59′.

THE FUTURE OF GEOLOGY.[1]

I PURPOSE, in this my retiring address, to make some observations and offer some suggestions as to the future of geology. Not, indeed, that I can claim the *rôle* of a prophet. But there are indications in the tone and manner of recent discussions and research which point clearly to the probable course of geological investigations in the immediate future. Geology has lately become too speculative. For at least a second time in its history we need to pause in order to gather up the records of the past, and to think seriously about the best method of progress in the future. A century ago, the conflict between the Wernerian and Huttonian theories was at its height. Speculation upon imperfect data ruled all. The practical work of William Smith and other English geologists, and the common sense of Englishmen, stayed this mad theorizing; and in the year 1807 the Geological Society of London was established for the express purpose of observing facts and recording observations. The results of this transference of energy from fierce controversy and dispute to patient investigation and labour of detail have been magnificent. And now again the old lines of controversy are reopened. The extraordinary revelations of recent microscopical research, and other improved modern methods, have necessarily reacted on physical geology; and there is once more great danger lest patient labour and accurate induction from proved data should give place to wild theorizing and acrimonious controversy.

The future of geology depends primarily on its practical uses. The method of its study, also, including the possible discovery of new methods of research, must be a potent factor in its development. Not less important is the consideration of the problems, whether physical, stratigraphical, or biological, which at present demand solution. And, as in all sciences and in all life, surrounding influences and environment have much to do with growth and progress. On each of these four points I wish to make a few remarks.

(1) The practical use of geology has received a striking illustration during the past year. Thirty-five years ago Mr. Godwin-Austen maintained the probability of Coal-measures beneath the newer strata of the south-east of England; and such Coal-measures have now been found. To the civil engineer, to the miner, to the stone-mason, builder, and architect, to the well-sinker and searcher for water, a knowledge of geology has become essential; and even so humble a person as the modern farmer and gardener might learn something from the coprolite and manure beds of the geologic series, and from the disposition of rocks and soils. During the past year nineteen committees appointed by the British Association have been concerned with geological subjects. Some of these are speculative and theoretic, but the majority are of practical use. The rate of increase of underground temperature has a direct bearing on mining operations; the circulation of underground waters is of great importance to the water-supply of towns and cities; the manure gravels of Wexford may revive the husbandry of Ireland; the flora of the Carboniferous rocks may throw light on the origin of coal and the probabilities of its occurrence in new localities; and even such apparently theoretic themes as the fossil Phyllopoda of the Palæozoic rocks, the Higher Eocene beds of the Isle of Wight, the erratic blocks sacred to our friends Dr. Crosskey and Mr. Martin, or the collection and identification of meteoric dust, may prove of importance in a practical direction. But not the least valuable are those researches which deal with foreign localities; and the Atlas Range of Morocco, the earthquakes of Japan, and volcanic phenomena of Vesuvius, may vie in value with the Bridlington sea-beach, and the action of waves and currents on the beds and foreshores of estuaries. So long as British enterprise is forcing its way to the centre of Africa, and exploring the Australian continent and the larger islands of the East, a fuller knowledge of foreign geology becomes imperative.

But apart from these matters of general interest or world-wide importance, the practical use of geology is exemplified in the researches of individual observers, and of societies like our own. The investigations of Dr. Callaway in the Uriconian rocks of Shropshire; the discovery by Dr. Lapworth of the Pre-Cambrian rocks at the Lickey and Nuneaton; and the more recent discovery by Mr. Landon of the Lower Bunter Sandstone at Barr Beacon, considerably to the east of the South Staffordshire coal-field, which had hitherto been thought to be its limit, are all illustrations of what may still be done by patient and zealous work. The crown of future success rests on the brow of toil and thought. Even the things of theory and speculation ofttimes become exalted into practical service by the growing developments of advancing knowledge, and the varying demands of human progress.

(2) I advance now to the method in which geology should be studied, and the possible discovery of new means of research. The day has long gone by when geology could be viewed "as a fashionable toy that everyone who has been to school is supposed capable of handling." No one now dares to touch its problems without some knowledge of physics, mathematics, biology, and chemistry. When Dr. Buckland led his tribe of random riders amongst the Oolitic strata of Oxford, or when Sir Roderick Murchison discoursed in sapient language on the rocks of Siluria, geology might have been a "fashionable toy." But not so now. The stern requirements of modern days have made it more accurate, and rendered it more sure. And with its enlargement has come an attention to minute detail, an observance of processes and of the results of processes which in the olden days had no place. To be a geologist now, at all events in the special phases of the science, a man must be either a mathematician, a physicist, a master of biology or of chemistry. Happy the man who can combine the whole!

Prof. A. H. Green, of Oxford, in his recent address as President of the Geological Section of the British Association, at Leeds, discoursed on the value of geology as an educational instrument. He began by admitting candidly that geologists were in danger continually of becoming loose reasoners, because the data from which they reasoned were necessarily scrappy and the geological record imperfect, or the facts were capable of interpretation in more than one way, or the determinations were shrouded in mist and obscurity. Notwithstanding this, he urged that the study of geology would be useful educationally by teaching wariness when the pupil comes to handle the complex problems of morals, politics, and religion. Further:—"There are immense advantages," he continues, "which the science may claim as an educational instrument. In its power of cultivating keenness of eye it is unrivalled, for it demands both microscopic accuracy and comprehensive vision. Its calls upon the chastened imagination are no less urgent, for imagination alone is competent to devise a scheme which shall link together the mass of isolated observations which field work supplies; and if, as often happens, the fertile brain devises several possible schemes, it is only when the imaginative faculty has been kept in check by logic that the one scheme that best fits each case will be selected for final adoption. But, above all, geology has its home, not in the laboratory or study, but *sub Jove*, beneath the open sky, and its pursuit is inseparably bound up with a love of Nature, and the healthy tone which that love brings alike to body and mind" (*Times* report, September 5; NATURE, vol. xlii. p. 455). Prof. Green proceeds to argue that geology should be taught in schools for more prosaic reasons; the two chief of which are that geography, and especially physical geography, cannot be taught without constant reference to certain branches of geology, and that there are many points of contact between the history of nations, the distribution and migrations of peoples, and the geological structures of the lands which they have dwelt in or marched over. And he concludes by sundry good illustrations of such school teaching, into which I need not now follow him.

Many may be disposed to think that this able and admirable address of Prof. Green is overstrained and overstated. But it must be remembered that, in order to convince the British public, it is necessary to state things strongly, and to draw things

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[1] Presidential Address by the Rev. G. Deane, D.Sc., delivered before the Birmingham Philosophical Society on October 8, 1890.

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